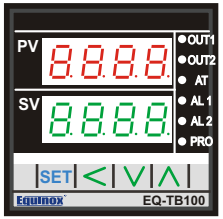
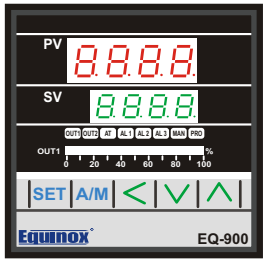
USER'S MANUAL

Equinox

Manual for
PID CONTROLLER



EQ-100



EQ-900

HTA®

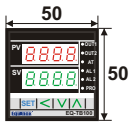
ISO 9001-2000 CERTIFIED

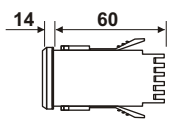
HTA INSTRUMENTATION PVT LTD.

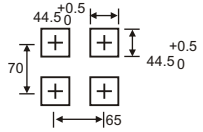
73, Ramachandra Agrahara, Near T. R. Mills, Chamarajpet, Bangalore-18.
TEL: 080-26749750, 26759253 FAX: 080-26740681,
E-mail: hitechas@eth.net, Web: www.htaipl.com

➪ EXTERNAL DIMENSION & PANEL CUTOUT [Unit : mm]

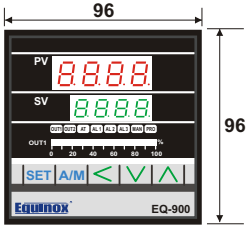
EQ-100

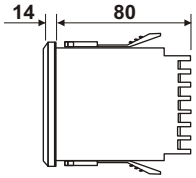


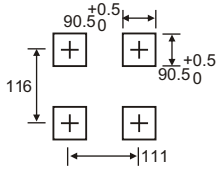




EQ-900

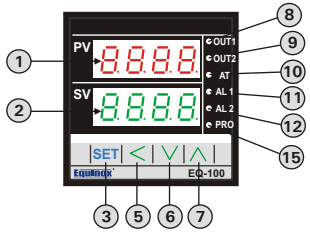






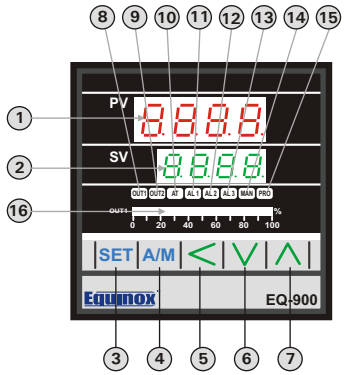
➪ PARTS DESCRIPTION

EQ-100



SYMBOL	NAME		FUNCTION
PV	①	Measured value (PV) display	Display PV or various parameter Symbols (Red)
SV	②	Setting value (SV) display	Display SV or various parameter set values (Green)
SET	③	Set Key	Used for parameter calling up & set value registration
A/M	④	Auto/Manual Key	Switches between Auto (PID) output mode & Manual Output
<	⑤	Shift Key	Shift digits when settings are changed
∨	⑥	Down Key (*Program Hold)	Decrease numbers (*Only for programmable controller)
∧	⑦	Up Key (*Program Run)	Increase Numbers (*Only for programmable controller)

EQ-900

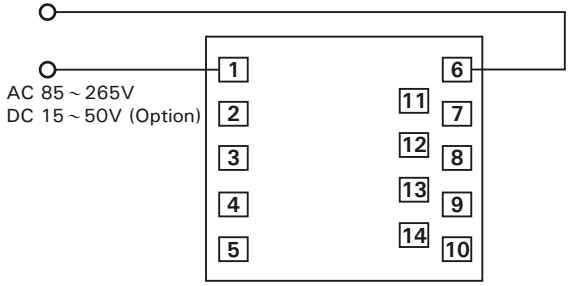


SYMBOL	NAME		FUNCTION
OUT1	⑧	OUT1 Lamp	Light when OUT1 is on (Green)
OUT2	⑨	OUT2 Lamp	Lights when OUT2 is on (Green)
AT	⑩	Auto-tuning Lamp	Lights when Auto-tuning is activated (Orange)
AL1	⑪	Alarm-1 Lamp	Lights when Alarm 1 is activated (Red)
AL2	⑫	Alarm-2 Lamp	Lights when Alarm 2 is activated (Red)
AL3	⑬	Alarm-3 Lamp	Lights when Alarm 3 is activated (Red)
MAN	⑭	Manual O/P Lamp	Lights when Manual Output is activated (Orange)
PRO	⑮	Program Running Lamp	Flashes when program running (Only for programmable controller)
OUT%	⑯	Output% Bar-Graph Display	Output% is displayed on 10-dot LEDS

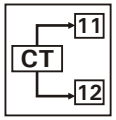
➪ **TERMINAL ARRANGEMENT**

EQ-100

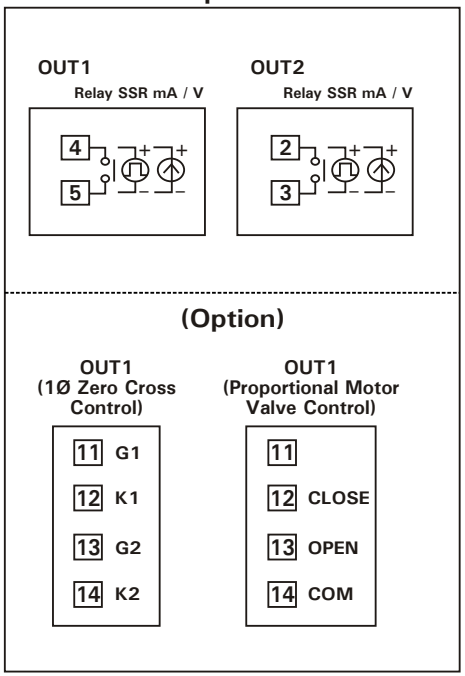
A. Power Supply



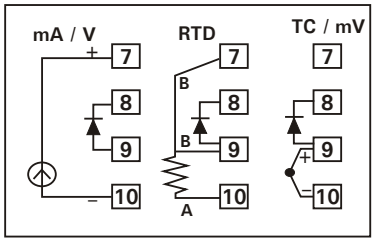
H. CT Input



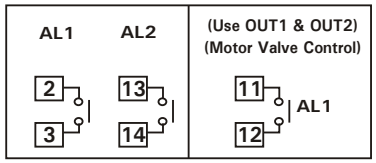
B. Control Output



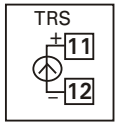
C. Input



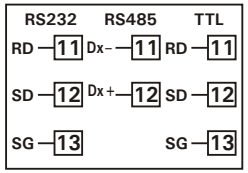
D. Alarm



E. Transmission

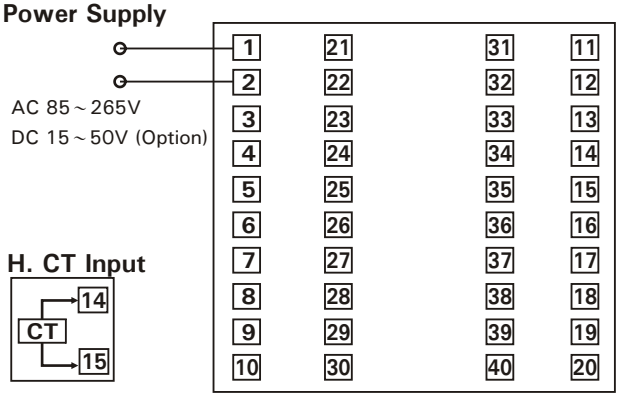


F. Communication

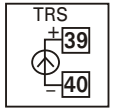


EQ-900

A. Power Supply

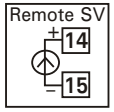


E. Transmission



H. CT Input

F. Remote



➪ APPLICATIONS

- **RAMP & SOAK**

- **RAMP :**

I. SET2.1 = 1 → To display AL3

II. SET4.1 = 1 → To display ALD3

III. ALD3 = 9 → Open RAMP option

IV. Then, AL3 will not display. It was replaced by RAMP.

RAMP
00.00

Range : 00.00 ~ 99.99(°C/ min)
(If RAMP is not used please set ALD3 to 0)

- **SOAK :**

I. ALD1 / ALD2 = 19 → To use Sock Timer.

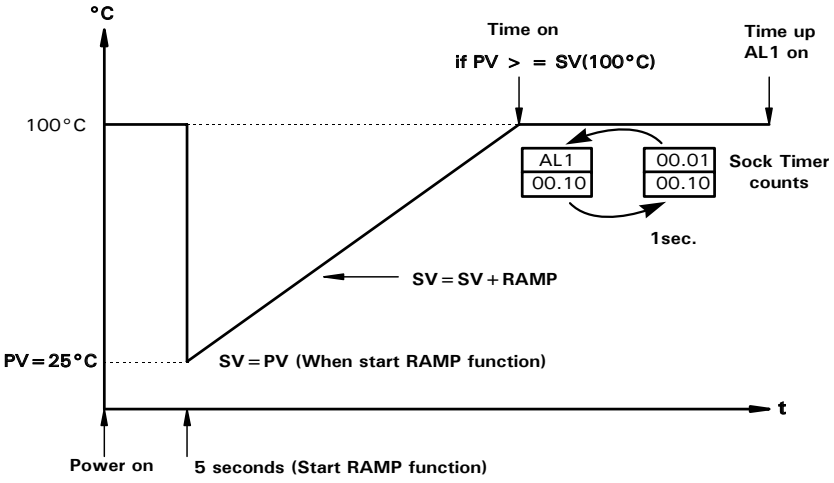
II. AL1 / AL2 will display as below:

AL1
00.00

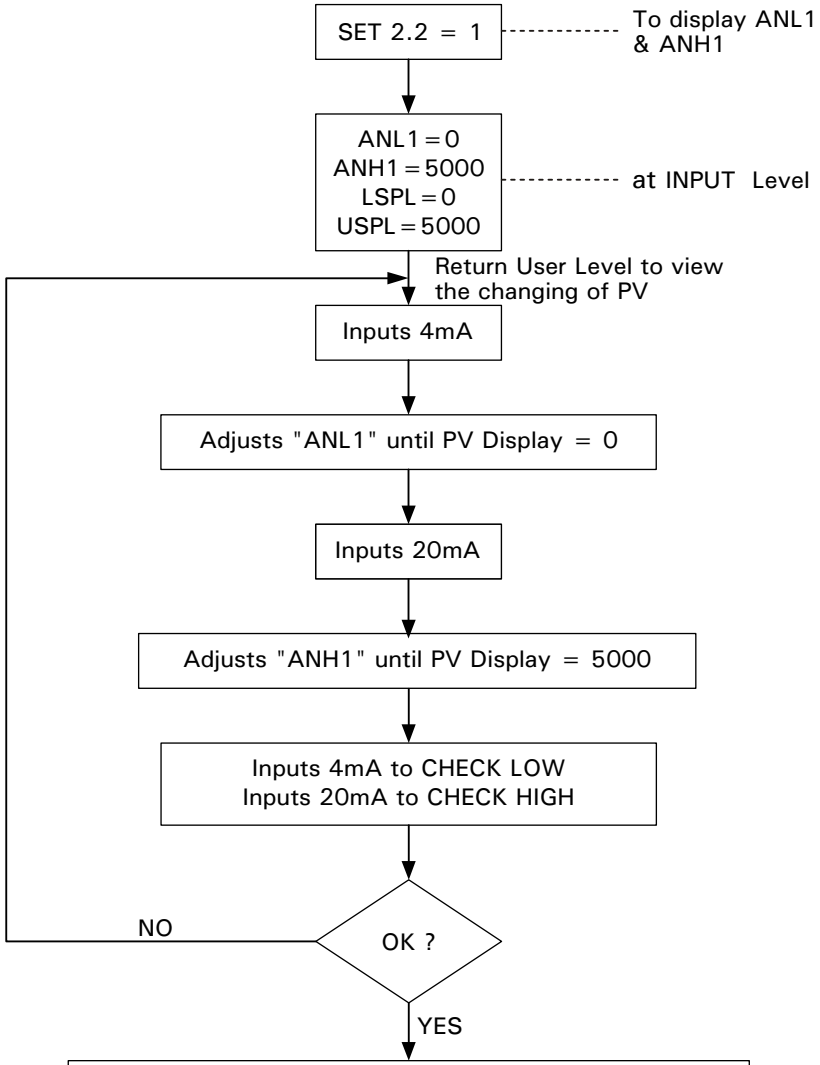
Range : 00.00 ~ 99.59 (Hour. Minute)

- **Example :**

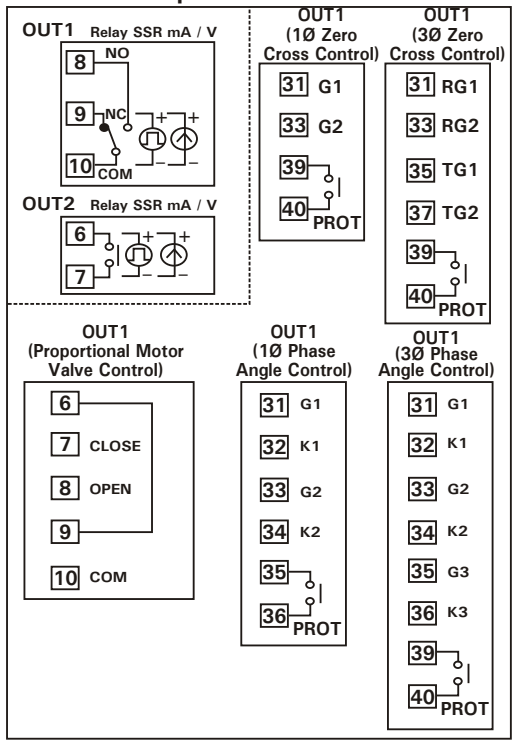
SV = 100°C RAMP = 10.00 (/min) ; AL1 = 00.10 min ; PV = 25°C



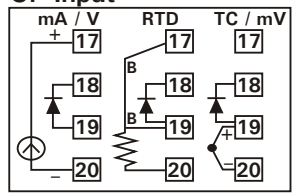
➪ CALIBRATION


SET 2.2 = 1
To display ANL1 & ANH1
ANL1 = 0
ANH1 = 5000
LSPL = 0
USPL = 5000
at INPUT Level
Return User Level to view the changing of PV
Inputs 4mA
Adjusts "ANL1" until PV Display = 0
Inputs 20mA
Adjusts "ANH1" until PV Display = 5000
Inputs 4mA to CHECK LOW
Inputs 20mA to CHECK HIGH
OK ?
NO
YES
Set the range you want :
LOW = LSPL ; HIGH = USPL
Ex : Low = -20.0 ; High = 50.0
SET : LSPL = -20.0 ; USPL = 50.0 ; DP : 000.0

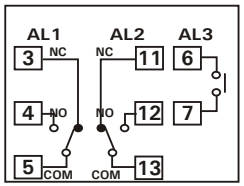
B. Control Output



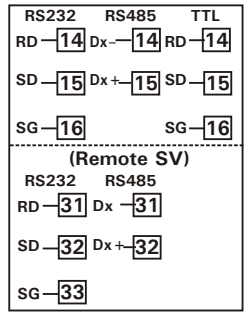
C. Input



D. Alarm

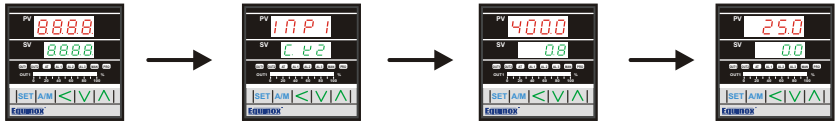


G. Communication



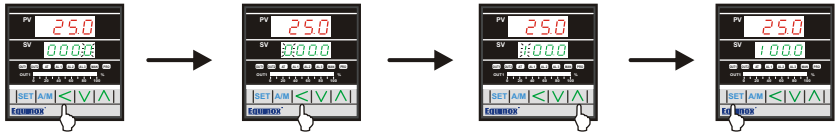
➪ OPERATIONS

1. Power ON : Controller will display as following



Light all LEDs & all 7 segment displays → Display input type → Display Range (0.0 ~ 400.0) → Read for use

2. Change the Set Value (SV) : Change SV from 0.0 to 100.0



Press (<) Key
The SV number started to flash. The flashing digit indicates which digit can be set.

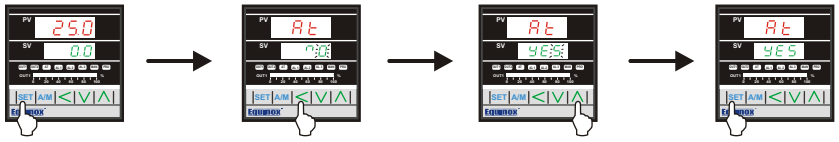
Press (<) Key
To select the hundreds digit.

Press (∧) Key
To change the number to 1.

Press (SET) Key
To store the new set value.

3. Auto-tuning (AT) :

Use AT function to automatically calculate and set the optimize PID value for your system.



Press (SET) Key
To display
Parameter AT.

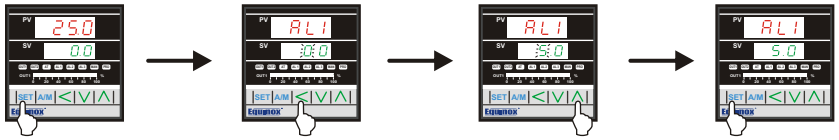
Press (<) Key
To change AT setting.

Press (∧) Key
Change AT to "YES"

Press (SET) Key
Start Auto-tuning
process (AT lamp
will be lighted on)

4. Change the Alarm Value :

Change AL 1 value to "5.0" (AL 1 active, if PV exceeds SV over 5.0)



Press (SET) Key
To display
Parameter AL1.

Press (<) Key
To change AL1 value

Press (∧) Key
Increase AL1 value

Press (SET) Key
Store the new
value of AL1

* There are total 16 alarm mode types, referenced as below :

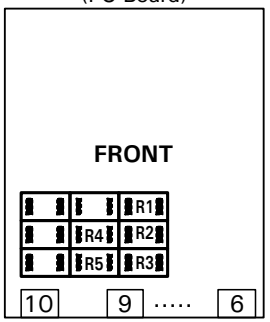
* To change Alarm mode, Press (SET) + (<) Key 5 seconds to enter Level 3 (Input Level) and then change the value of ALD1 / ALD2 / ALD3

5. Alarm Mode Type (Referenced for ALD1 / ALD2 / ALD3) :

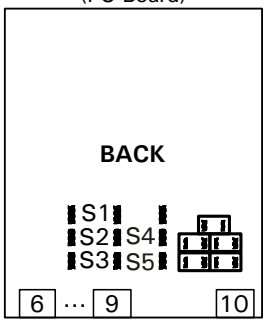
(▼ : SV △ : Alarm set value)

01	**Deviation High Alarm with Hold Action*** OFF ON △HIGH PV
11	**Deviation High Alarm** OFF ON △HIGH PV
02	**Deviation Low Alarm with Hold Action*** △HIGH PV
12	**Deviation Low Alarm** ON OFF △HIGH PV
03	**Deviation High/Low Alarm with Hold Action*** ON OFF ON LOW △ ▲ △HIGH PV
13	**Deviation High/Low Alarm** ON OFF ON LOW △ ▲ △HIGH PV
04 14	**Band Alarm** OFF ON OFF LOW △ ▲ △HIGH PV
05	**Process High Alarm with Hold Action*** OFF ON Low △ HIGH PV
15	**Process High Alarm** OFF ON Low △ HIGH PV
06	**Process Low Alarm with Hold Action*** ON OFF LOW △ HIGH PV
16	**Process Low Alarm** ON OFF LOW △ HIGH PV
07	**Segment End Alarm (Only for Programmable Controller)** (1) ALD1 ~ 3, set 07 (2) ALD1 ~ 3 = Alarm Segment (3) ALT1 ~ 3 defines as follows: **0** = Flicker Alarm **99.59** = Continued Alarm **others** = Alarm ON Time
17	**Program Run Alarm (Only for Programmable Controller)** Run Stop ON OFF AL
08	**System Failed Alarm* (ON)** Normal Failed OFF ON AL
18	**System Failed Alarm* (OFF)** Normal Failed OFF ON AL
09	**Heater Break Alarm (HBA)**
00 10	**No Alarm**

48 × 48
(PC Board)



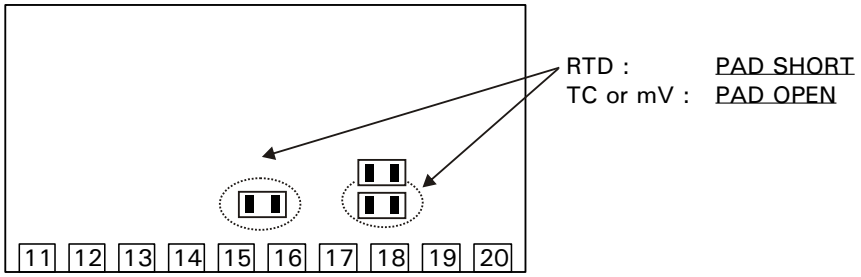
48 × 48
(PC Board)



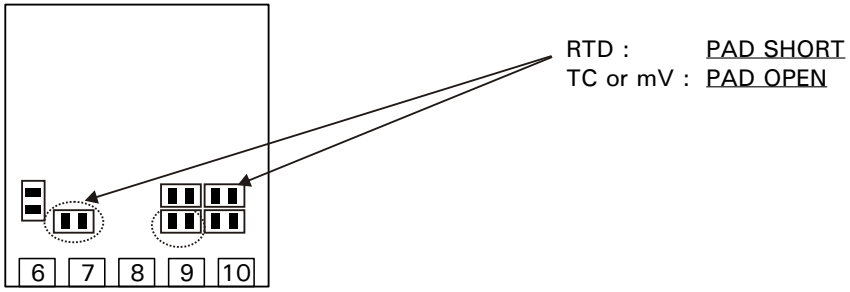
➪ **Modification of Input "TC" ⇄ "RTD" (on PC board)**

If the controller needs modification from **TC** or **RTD** type, please make PAD short on PC board back as following diagram and changing input selection. On the contrary, modify from **RTD** to **TC** or **mV**, make PAD open.

96 × 96, 48 × 96, 96 × 48
(PC Board)



48 × 48
(PC Board)



➪ **Modification of output "Relay" ⇄ "SSR" ⇄ "4 ~ 20mA"**

If just needs to change a module at the same position & modify parameter **CYT1** in LEVEL 2.

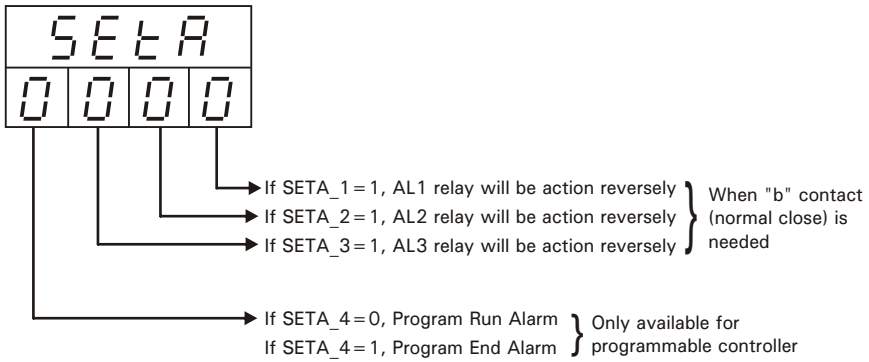
➪ Alarm

Alarm Time (ALT1 / ALT2 / ALT3)

ALT1 = 0	Flicker Alarm
ALT1 = 99.59	Continued Alarm
ALT1 = 00.01 ~ 99.58	Alarm on delay time

➪ SETA

*SETA is in Level 3 (Input Level)


SEtA
0 0 0 0
If SETA_1 = 1, AL1 relay will be action reversely
If SETA_2 = 1, AL2 relay will be action reversely
If SETA_3 = 1, AL3 relay will be action reversely
When "b" contact (normal close) is needed
If SETA_4 = 0, Program Run Alarm
If SETA_4 = 1, Program End Alarm
Only available for programmable controller

➪ Modify Input Type : Linear Input (mA / V)

- **EQ-100, EQ- 900 Hardware :**

0 ~ 20mA (INP1 = AN4) : (R3 use 100Ω , R5 use 2.4Ω , S3 & S5 SHORT)

4 ~ 20mA (INP1 = AN5) : (R3 use 100Ω , R5 use 2.4Ω , S3 & S5 SHORT)

0 ~ 1V (INP1 = AN4) : (R1 use 2KΩ , R4 use 100Ω , S1 & S4 SHORT)

0 ~ 5V (INP1 = AN4) : (R2 use 10KΩ , R4 use 100Ω , S2 & S4 SHORT)

1 ~ 5V (INP1 = AN5) : (R2 use 10KΩ , R4 use 100Ω , S2 & S4 SHORT)

0 ~ 10V (INP1 = AN4) : (R3 use 22KΩ , R4 use 100Ω , S3 & S4 SHORT)

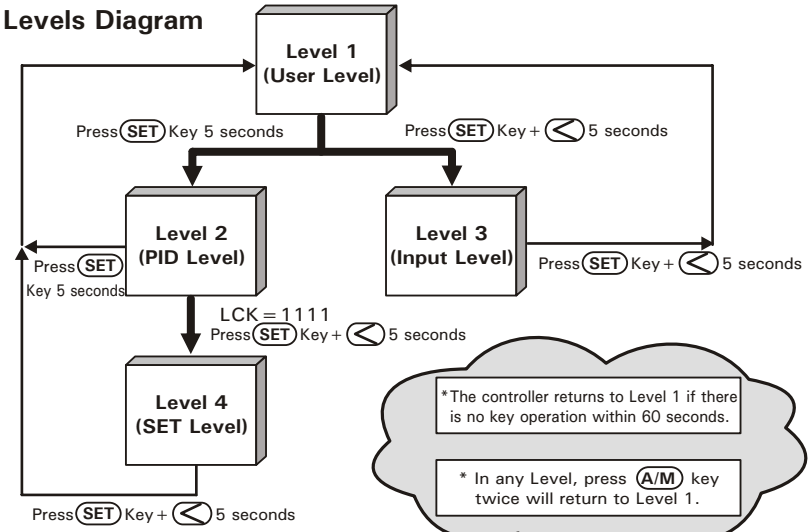
2 ~ 10V (INP1 = AN5) : (R3 use 22KΩ , R4 use 100Ω , S3 & S4 SHORT)

***Hold Action:**
When Hold action is ON, the alarm action is suppressed at start-up until the measured value (PV) enters the non-alarm range.

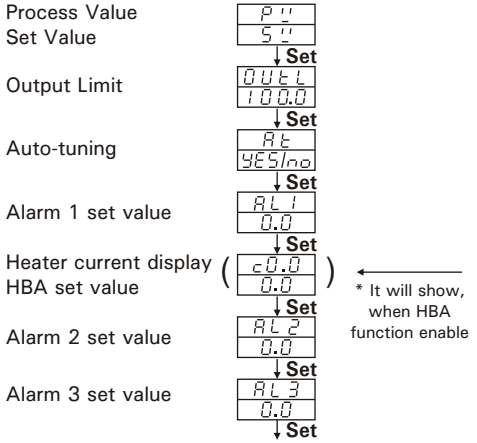
***System Failed:**
It means that the controller display error message with one of following :
"UUU1 or "NNN1 or "CJCE"

➪ PARAMETER LIST

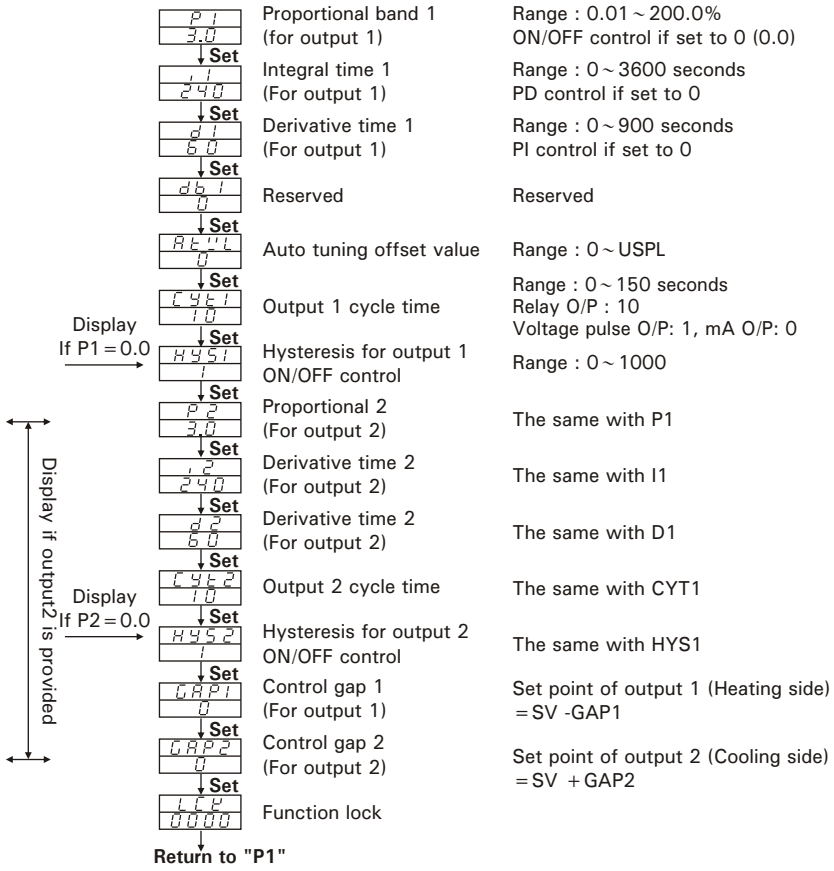
Levels Diagram


Level 1 (User Level)
Press SET Key 5 seconds
Press SET Key + 5 seconds
Level 2 (PID Level)
Level 3 (Input Level)
Press SET Key 5 seconds
Press SET Key + 5 seconds
LCK = 1111
Press SET Key + 5 seconds
Level 4 (SET Level)
Press SET Key + 5 seconds
*The controller returns to Level 1 if there is no key operation within 60 seconds.
* In any Level, press A/M key twice will return to Level 1.

➪ LEVEL 1 (User Level)



➪ LEVEL 2 (PID LEVEL)



LCK	Levels Entering Available			Parameters which can be changed
	Level 1 (User)	Level 2 (PID)	Level 3 (Input)	
0000	◎	◎	◎	All parameters (Factory set value)
1111	◎	◎	--------	All parameters
0100	◎	◎	--------	All parameters except level 3
0110	◎	◎	--------	Parameters in level 1
0001	◎	◎	--------	"SV" and "LCK"
0101	◎	◎	--------	Only "LCK"

- **Description of operation**

1. There are 2 patterns can be used ' each pattern contains 8 segments.
2. Terminologies

Pattern : A program consists of some steps.
Ramp status : The status with changing SV.
Soak status : The status with fixed SV.

- **Operating**

I. "KEY" function (no changing parameter)

△ (RUN) : Start program procedure ' **PRO** LED in panel start flicking.
▽ (HOLD) : Suspend program procedure ' **PRO** LED in panel will stop flicker but still light on.
△ +SET (JUMP) : Jump to previous segment.
▽ +SET (RESET) : Reset program procedure ' **PRO** LED in panel will off.

II. Alarm Function

ALD1 = "07"(Segment end alarm)
AL1 = "2"(It means when segment 2 end,AL1 will act)
ALT1 = "00:10"(Relay on time is 10 seconds).
* In this case ' when program proceeds to segment 2 end ' the relay of AL1 will be on 10 seconds.

III. END function :

The Controller doesn't have END order, so if program procedure is less than 8 segments, please set the last segment's OUT to "0". Program will end in this segment. Otherwise ' it will proceed 8 or 16 segments.

IV. Linking Function :

PTN = 1 proceed pattern 1 ' contains 8 segments.
PTN = 2 proceed pattern 2 ' contains 8 segments.
PTN = 0 linking proceed pattern 1 and 2 totally 16 segments.
(Please set PTN1 and PTN2 at first ' and then set PTN to 0)

V. Other function (* refer to LEVEL 4)

SET 8_1 = 1 Program repeats.
SET 8_2 = 0 No power failure function.
SET 8_2 = 1 Enable power failure function.
(When power shut down and on again ' the controller will start from the segment which is near PV)

SET 8_3 = 0 Program starts from 0.
SET 8_3 = 1 Program starts from PV.

SET 9_2 = 0 Timer Unit = "Hour : Minute"
SET 9_2 = 1 Timer Unit = "Minute : Second"

➪ Program Level (Only displayed in programmable controller)

- **Description of parameters**

LEVEL 1

Set

PtN / 1	Program Pattern Range : 0 ~ 2
SEG / 1_0	Program Segment display (Pattern _ Segment)
t.Cr / 00.00	Program countdown display Range : 0 ~ 99 hour 59 min
SV-1 / 100.0	Setting value of Seg.1 Range : LSPL ~ USPL
tM-1 / 00.01	Set time for Seg.1 Range : 0 ~ 99hour 59min
OUt1 / 100.0	Output Limit of Seg.1 Range : 0 ~ 100% If OUT = 0 program will end.
SV-2 / 100.0	Setting value of Seg.2
tM-2 / 00.10	Set time for Seg.2
OUt2 / 100.0	Output Limit of Seg.2
SV-3 / 0.0	Setting value of Seg.3
tM-3 / 0000	Set time for Seg.3
OUt3 / 0.0	Output Limit of Seg.3
SV-4 / 0.0	Setting value of Seg.4
tM-4 / 00.00	Set time for Seg.4
OUt4 / 0.0	Output Limit of Seg.4
SV-5 / 0.0	Setting value of Seg.5
tM-5 / 00.00	Set time for Seg.5
OUt5 / 0.0	Output Limit of Seg.5
SV-6 / 0.0	Setting value of Seg.6
tM-6 / 00.00	Set time for Seg.6
OUt6 / 0.0	Output Limit of Seg.6
SV-7 / 0.0	Setting value of Seg.7
tM-7 / 00.00	Set time for Seg.7
OUt7 / 0.0	Output Limit of Seg.7
SV-8 / 0.0	Setting value of Seg.8
tM-8 / 00.00	Set time for Seg.8
OUt8 / 0.0	Output Limit of Seg.8

Set

Return LEVEL 1

➪ ERROR DISPLAYS

in1E	**IN1E : Input 1 Error** Check whether input loop is opened or wiring incorrect.
CJCE	**CJCE : Cold Junction Compensation Failed** Check the compensation diode outside controller.
uuu1	**UUU1 : PV is above USPL** Check whether the input value is correct or not.
nnn1	**NNN1 : PV is below LSPL** Check whether the input value is correct or not.
AdCF	**ADCF : A/D Convert Failed** Controller needs to be repaired.
rAMF	**RAMF : RAM Failed** Controller needs to be repaired.

➪ LEVEL 3 (Input Level)

INP1 / 32	Input type selection	
ANL1 / 0	Analog input low limit calibration (Used for mA & V input)	Range: –1999 ~ 9999
ANH1 / 5000	Analog input high limit calibration (Used for mA and V input)	Range: 0 ~ 9999
dP / 0000	Decimal point position (Available for mA & V input)	0000, 000.0, 00.00, 0.000
L.SP.L / 0.0	Lower Set-Point Limit	Scaling Low Limit
U.SP.L / 400.0	Upper Set-Point Limit	Scaling High Limit
ANL2 / 0	Remote input low limit calibration	Range: –1999 ~ 9999
ANH2 / 5000	Remote input high limit calibration	Range: 0 ~ 9999
ALd1 / 11	Alarm Mode of AL1	Range: 00.19 Refer to "Alarm Mode Type"
ALt1 / 99.59	Alarm Time of AL1	Range: 0 ~ 99 Min. 59 Secs. 0 = Flicker Alarm 99:59 = Continued Others = On delay time (If ALD = 07, ALT means alarm on time)

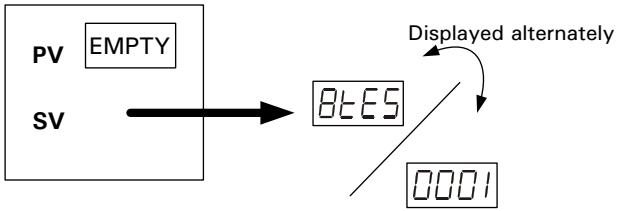
Set

ALd2 / 0	Alarm Mode of AL2	The same with ALD1
ALt2 / 99.59	Alarm Time of AL2	The same with ALT1
ALd3 / 0	Alarm Mode of AL3	The same with ALD1
ALt3 / 99.59	Alarm Time of AL3	The same with ALT1
HYSA / 0.0	Hysteresis of all Alarm	Range: 0 ~ 1000
CLO1 / 230	Output 1 low limit Calibration (Used for mA and V output)	Range: 0 ~ 9999
CHO1 / 3600	Output 1 high limit calibration (Used for mA and V output)	Range: 0 ~ 9999
CLO2 / 230	Output 2 low limit calibration (Used for mA and V output)	The same with CLO1
CHO2 / 3600	Output 2 high limit calibration (Used for mA and V output)	The same with CHO1
CLO3 / 0	Retransmission low limit calibration	The same with CLO1
CHO3 / 5000	Retransmission high limit calibration	The same with CHO1
rUCY / 5	Full run time of proportional motor (Used for proportional motor valve control output)	Range: 5 ~ 200 seconds
JA.t / 00	Used for programmable controller to wait continued operation	0 = Not wait Others = Wait value
SEtA / 0000		
PSL / rtU	Communication Protocol Selection	MODBUS RTU / MODBUS ASCII / TAIE
b.tS / o_81	Communication Bits Configuration	O_81/O_82/E_81/E_82

Set

Please don't operate **SET 8_4,** otherwise the controller's process will be in confusion.

If SET8.4 is set to "1", the controller will enter into "Single Display" mode, the PV LED will not display any values. The SV LED will display both the parameter value and the setting value alternately as shown in the diagram below.



To rectify the problem please press the SHIFT KEY (◁) and change the setting value to "0000".

- **Remote SV Type Selection**

  INP2 = 0 None

  INP2 = 1 10 ~ 50mV / 4 ~ 20mA / 1 ~ 5V / 2 ~ 10V

  INP2 = 2 0 ~ 50mV / 0 ~ 20mA / 0 ~ 5V / 0 ~ 10V

  INP2 = 4 CT input

  ⌖ Remote SV function is not available for programmable controller

- **Output Mode Selection (Use OUTY)**

  OUTY = 0 Single output (OUT1)

  OUTY = 1 Dual output (OUT1 / OUT2)

  OUTY = 2 Reserved

  OUTY = 3 3 wire proportional motor valve control

  OUTY = 4 1 ψ Phase angle control (1ψSCR)

  OUTY = 5 3 ψ Phase angle control (3ψSCR)

- **Modify caution**

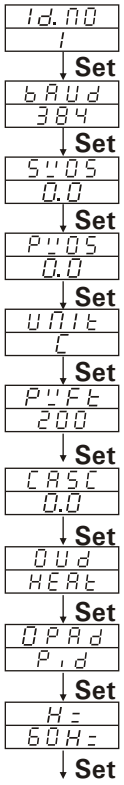
  If change parameter "BAUD", "BITS", "RUCY", "OUTY" the power must be reset

➪ Special functions (Use SET8 / SET9 / SET0)

SET 8		Remark
8_ 1	0 : Program not repeat	Only available for programmable controller
	1 : Program repeat	
8_ 2	0 : No power failure option	
	1 : With power failure option	
8_ 3	0 : Program starts from 0	
	1 : Program starts from PV	
8_ 4	0 : Reserved (Don't change it)	

SET 9		Remark
9_ 1	0 : Reserved (Don't change it)	
9_ 2	0 : Timer Unit = "Hour : Minute"	Only available for programmable controller
	1 : Timer Unit = "Minute : Second"	
9_ 3	0 : Disable transmission	Used for transmission output
	1 : SV Transmission	
9_ 4	0 : Disable transmission	
	1 : PV Transmission	

SET 0		Remark
0_ 1	0 : TTL Communication (Slave)	Used for TTL communication
	1 : TTL Communication (Master)	
0_ 2	0 : Hide parameter "RATE"	
	1 : Display parameter "RATE"	AL3 will be replaced by "RATE"
0_ 3	0 : Disable Remote SV function	Used for Remote SV function
	1 : Enable Remote SV function	
0_ 4	0 : use output relay "b" contact when motor valve closed	Used for 3 wire proportional motor valve control
	1 : use output relay "a" contact when motor valve closed	



ID number	Range: 0 ~ 255
Baudrate	2400/4800/9600/19200/ 38400/ bps
SV compensation	Range: –1000 ~ 1000
PV compensation	Range: –100.0 ~ 500.0
Unit of PV & SV	C (°C) / F (°F) /A (Analog)
PV Filter	PV will response faster if PVFT is smaller.
Reserved	
Control mode	Heat / Cool
Control algorithm	PID / Fuzzy
Frequency	50 / 60HZ

Return to "INP1"

INPUT TYPE TABLE

		Type	Range	Type	Range	Type	Range
TC	K	*K1*	0.0 ~ 200.0°C (392.0°F)	*K2*	0.0 ~ 400.0°C (752.0°F)	*K3*	0 ~ 600°C (1112°F)
		K4	0 ~ 800°C (1472°F)	*K5*	0 ~ 1000°C (1832°F)	*K6*	0 ~ 1200°C (2192°F)
	J	*J1*	0.0 ~ 200.0°C (392.0°F)	*J2*	0.0 ~ 400.0°C (752.0°F)	*J3*	0 ~ 600.0°C (1112°F)
		J4	0 ~ 800°C (1472°F)	*J5*	0 ~ 1000°C (1832°F)	*J6*	0 ~ 1200°C (2192°F)
	R	*R1*	0 ~ 1600°C (2912°F)	*R2*	0 ~ 1769°C (3216°F)		
	S	*S1*	0 ~ 1600°C (2912°F)	*S2*	0 ~ 1769°C (3216°F)		
	B	*B1*	0 ~ 1820°C (3308°F)				
	E	*E1*	0 ~ 800°C (1472°F)	*E2*	0 ~ 900°C (1652°F)		
	N	*N1*	0 ~ 1200°C (2192°F)	*N2*	0 ~ 1300°C (2372°F)		
	T	*T1*	–199.9 ~ 400.0°C (752.0°F)	*T2*	–199.9 ~ 200.0°C (392.0°F)	*T3*	0.0 ~ 350.0°C (662.0°F)
	W	*W1*	0 ~ 2000°C (3632°F)	*W2*	0 ~ 2320°C (4208°F)		
	PLII	*PL1*	0 ~ 1300°C (2372°F)	*PL2*	0 ~ 1390°C (2534°F)		
	U	*U1*	–199.9 ~ 600.0°C (999.9°F)	*U2*	–199.9 ~ 200.0°C (392.0°F)	*U3*	0.0 ~ 400.0°C (752.0°F)
	L	*L1*	0 ~ 400°C (752°F)	*L2*	0 ~ 800°C (1472°F)		

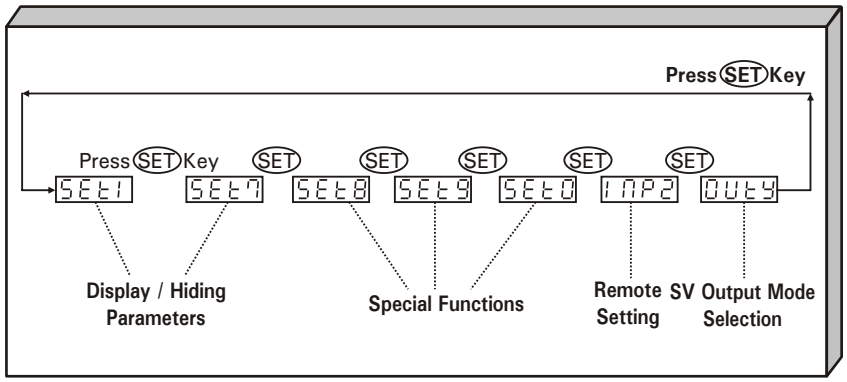
INPUT TYPE TABLE

		Type	Range	Type	Range	Type	Range
RTD	JPT	*JP1*	-199.9 ~ 600.0°C (999.9°F)	*JP2*	-199.9 ~ 400.0°C (752.0°F)	*JP3*	-199.9 ~ 200.0°C (392.0°F)
	100	*JP4*	0 ~ 200°C (392°F)	*JP5*	0 ~ 400°C (752°F)	*JP6*	0 ~ 600°C (1112°F)
	PT	*DP1*	-199.9 ~ 600.0°C (999.9°F)	*DP2*	-199.9 ~ 400.0°C (752.0°F)	*DP3*	-199.9 ~ 200.0°C (392.0°F)
	100	*DP4*	0 ~ 200°C (392°F)	*DP5*	0 ~ 400°C (752°F)	*DP6*	0 ~ 600°C (1112°F)
	JPT	*JP.1*	-199.9 ~ 600.0°C (999.9°F)	*JP.2*	-199.9 ~ 400.0°C (752.0°F)	*JP.3*	-199.9 ~ 200.0°C (392.0°F)
	50	*JP.4*	0 ~ 200°C (392°F)	*JP.5*	0 ~ 400°C (752°F)	*JP.6*	0 ~ 600°C (1112°F)

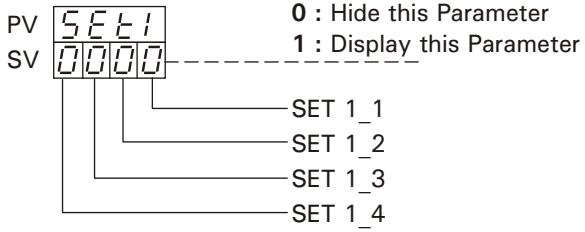
	Type	Range	
LINEAR	*AN1*	-10 ~ 10mV	-1999 ~ 9999 or -199.9 ~ 999.9 or -19.99 ~ 99.99 or -1.999 ~ 9.999
	AN2	0 ~ 10mV	
	AN3	0 ~ 20mV	
	AN4	0 ~ 50mV	
	An5	10 ~ 50mV	

➪ LEVEL 4 (SET Level)

To enter level 4. set LCK to "1111 and then press SET key + Shift (◁) key 5 seconds.



➪ How to Hide Parameters (Use SET1 ~ SET7)



*For the description of Level 1 Parameters, please refer with page 17.
*For the description of Level 3 Parameters, please refer with page 20.

SET	Display / Hiding	Level	SET	Display / Hiding	Level
1_1	OUtL	Level 1	5_1	CLO2, CHO2	Level 3
1_2	At	Level 1	5_2	CLO3, CHO3	Level 3
1_3	AL 1	Level 1	5_3	rU.CY, JA, t, SEtA	Level 3
1_4	AL 2	Level 1	5_4	PSL, b, tS, Id.NO, bAUd	Level 3
2_1	AL 3	Level 1	6_1	SUOS	Level 3
2_2	ANL1, ANH1, dP	Level 3	6_2	PUOS	Level 3
2_3	L.S.P.L, U.S.P.L	Level 3	6_3	UNIt	Level 3
2_4	ANL2, ANH2,	Level 3	6_4	PUFt	Level 3
3_1	ALd 1	Level 3	7_1	CASC	Level 3
3_2	ALt 1	Level 3	7_2	OUd	Level 3
3_3	ALd 2	Level 3	7_3	OPAd	Level 3
3_4	ALt 2	Level 3	7_4	H=	Level 3
4_1	ALd 3	Level 3			
4_2	ALt 3	Level 3			
4_3	HYSA	Level 3			
4_4	CLO1, CHO1	Level 3			